# DCA studies using KalFitReco

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- DCA resolution optimization

- Do we need good DCA resolution (toy model)?

- Attempt at charm/bottom separation

DCA resolution optimization

DCA resolution optimization

- Change weights assigned to hits from different layers, and try to find the best combination.
- Single electrons.
- Best results when inner layers have large weight, outer layers small weight.
- Even without strip layers we have good resolution.
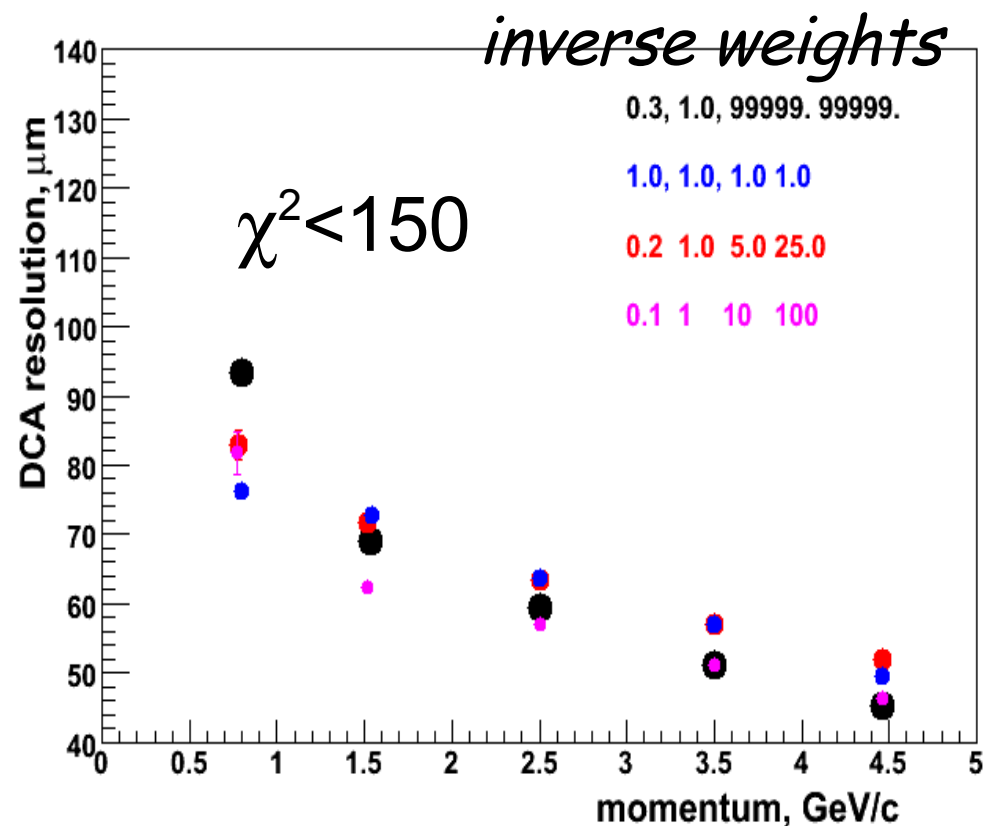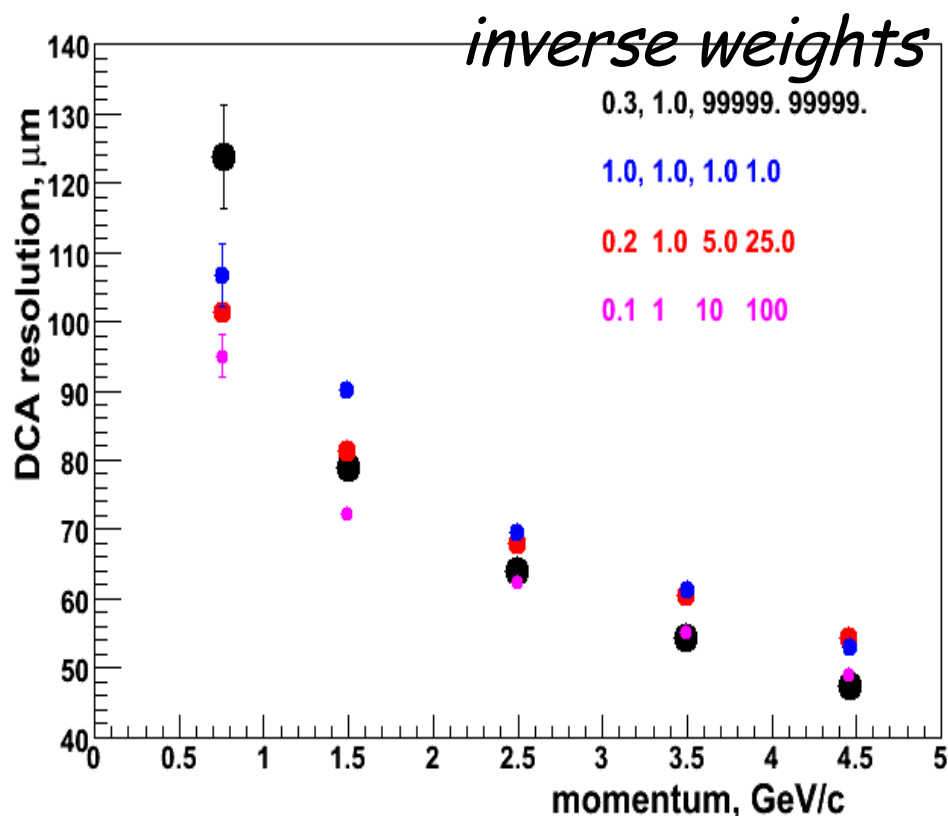
DCA resolution vs P_T for electrons and pions

Resolution is good, but somewhat worse than 2 year old results
Better detector response: charge sharing, clustering, noise.
But do we need good DCA resolution?
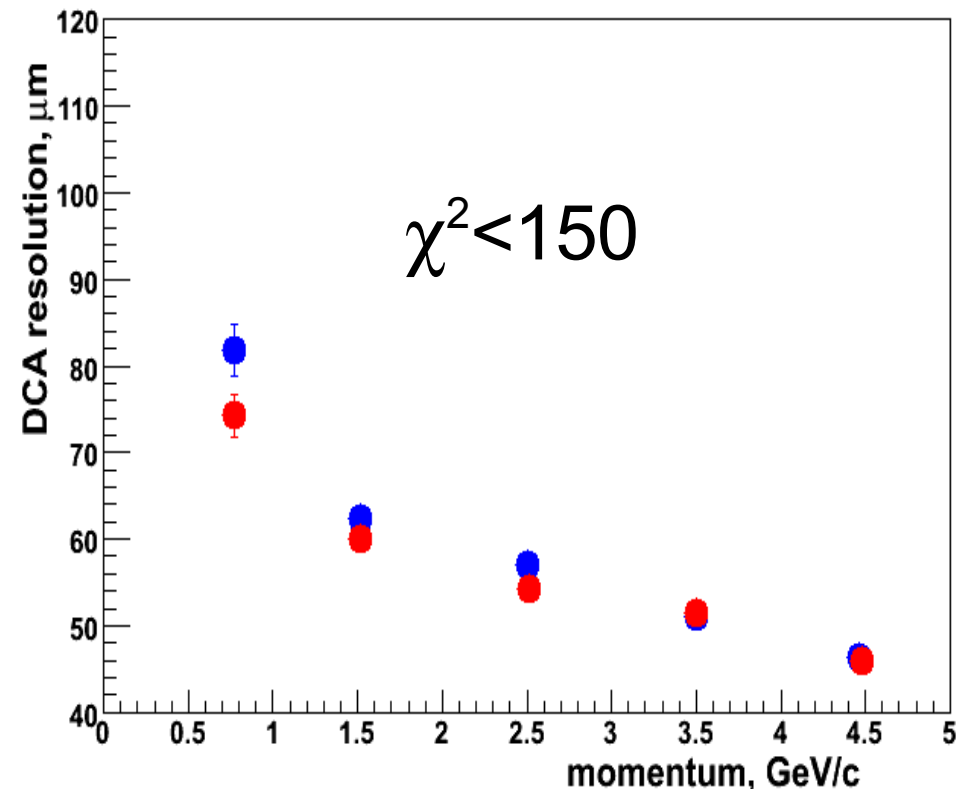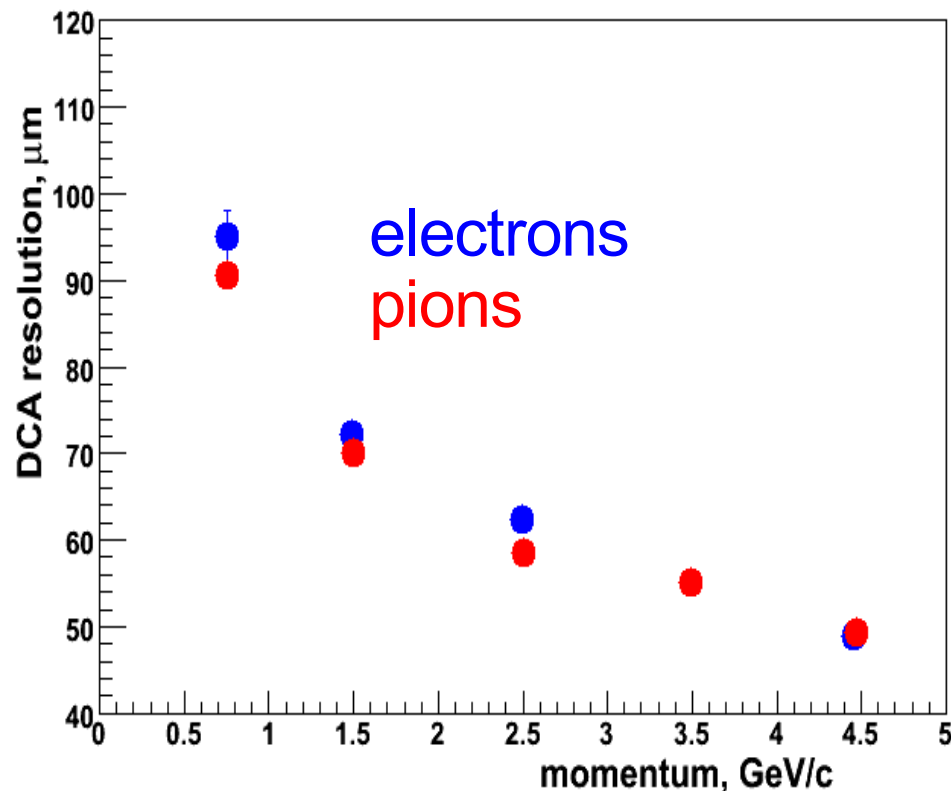
Problem: even if particle decays far away from the vertex,
we can often get zero DCA.

Do we need good DCA resolution? (toy model)

Toy model

- Decay D mesons at 312 μm from the vertex (cτ) to e and ν
  - this never happens; the most probable decay is Keν, but for simplicity...

- Decay is uniform in D rest frame, and then electron is boosted by D momentum.

- Perfect DCA is calculated, neglecting magnetic field.
  - we assume perfect DCA resolution and perfect vertex knowledge.

- This is the best we can expect for decays away from the vertex.

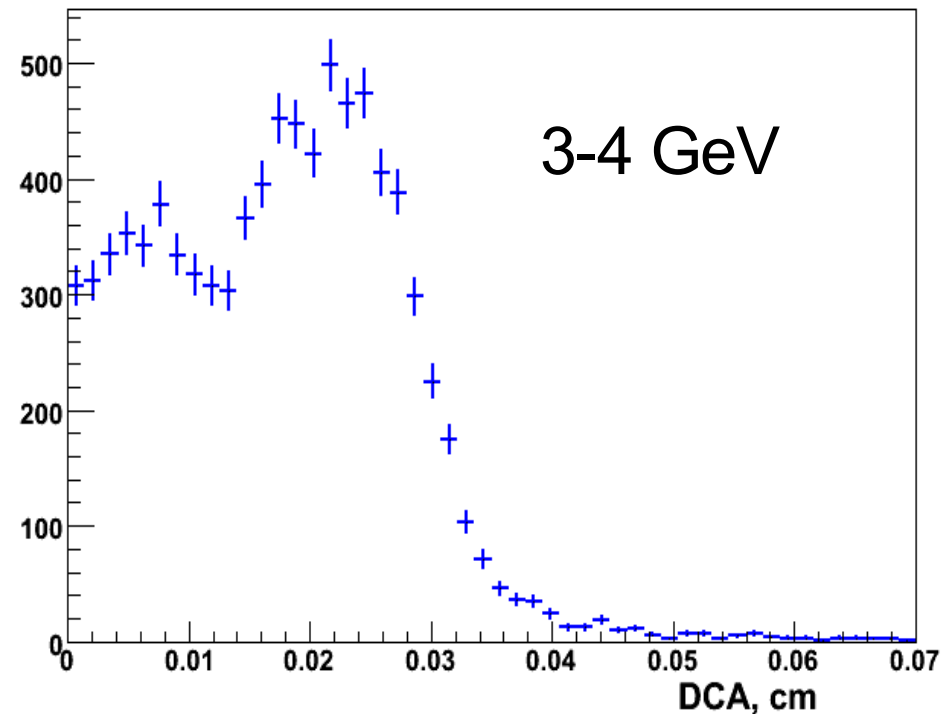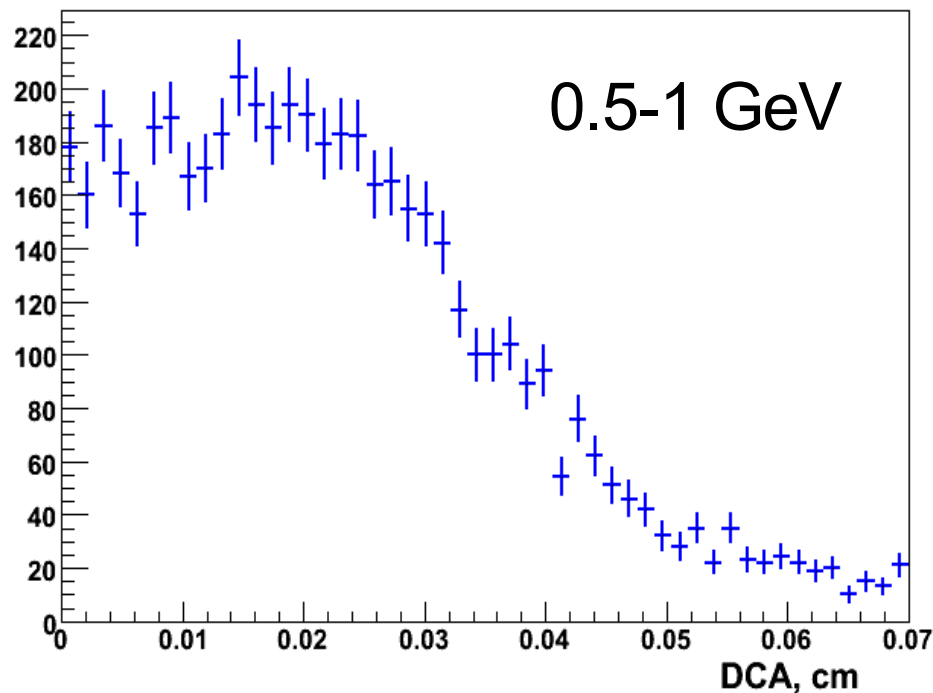- Add some DCA smearing (Gaussian) to see how it affects results.

Toy model results vs D meson P$_T$
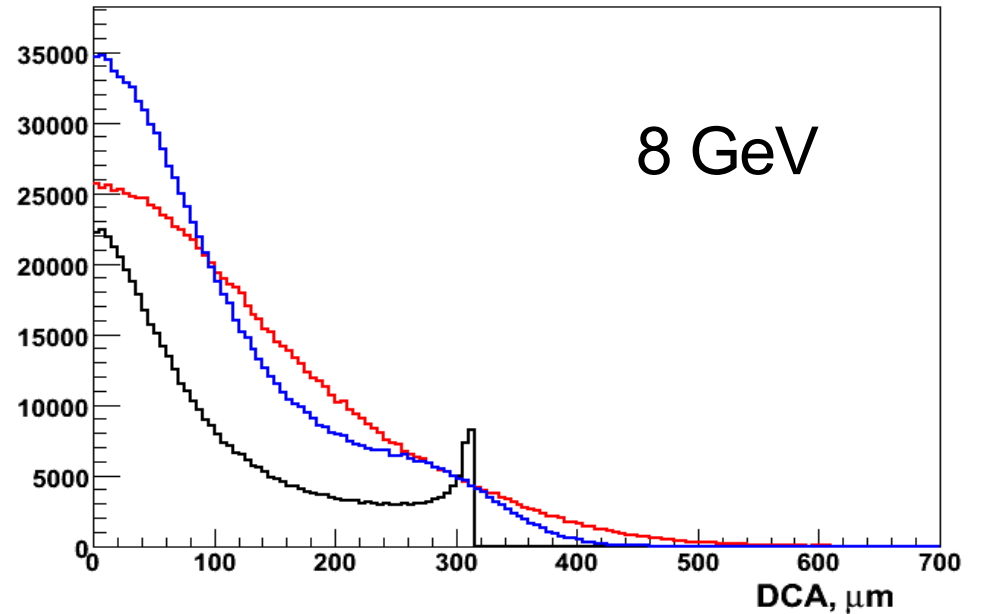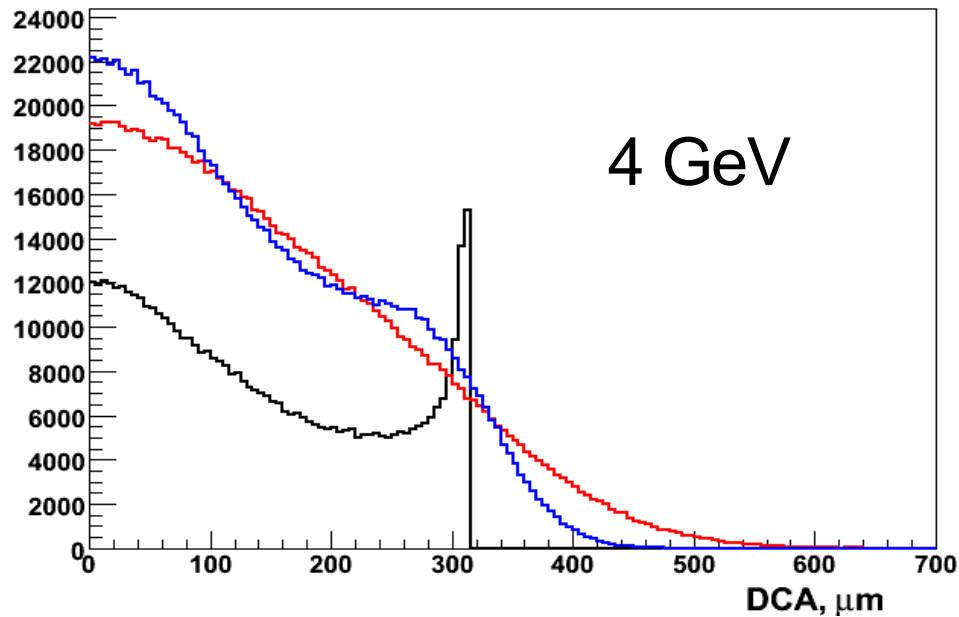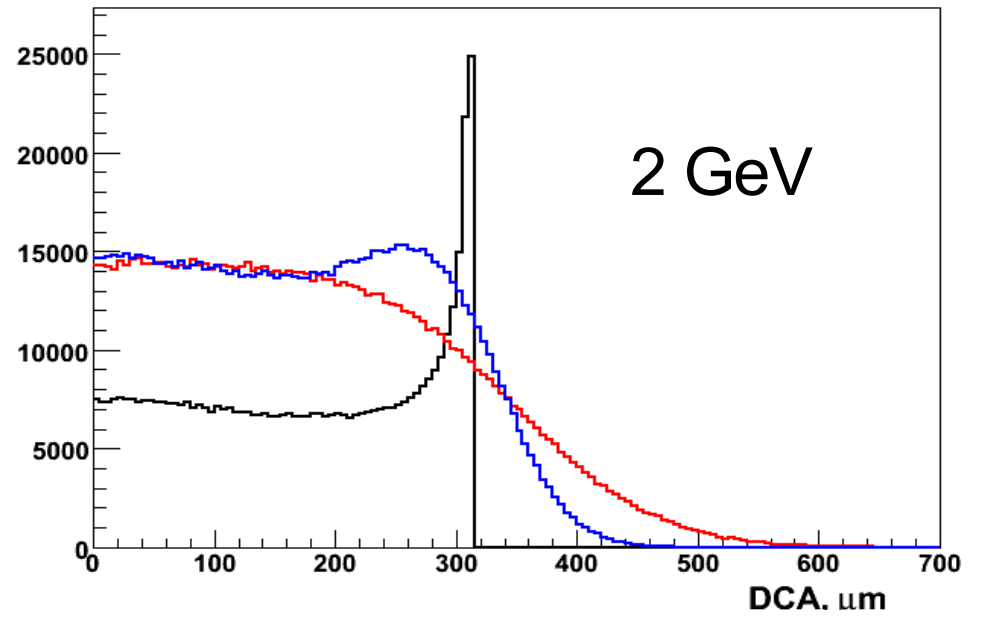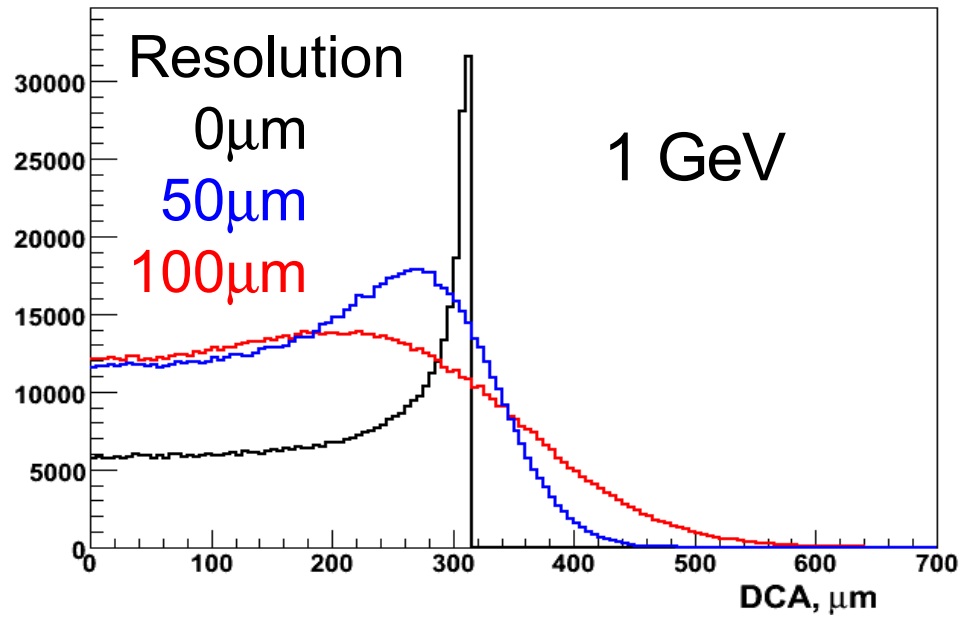
Cross-check with full simulation

Generated electrons with V_X = 200 µm, V_Y = 200 µm, but told KalFitReco that the vertex is at (0,0).

- Distance to the vertex 283 µm
- Reconstructed DCA
- No boost
- PHENIX geometry affects DCA distribution (better resolution in Y)

0.5-1 GeV

3-4 GeV

We need good DCA resolution to reject background from the vertex, but for c/b separation DCA resolution is not important, as long as it is less than cτ !
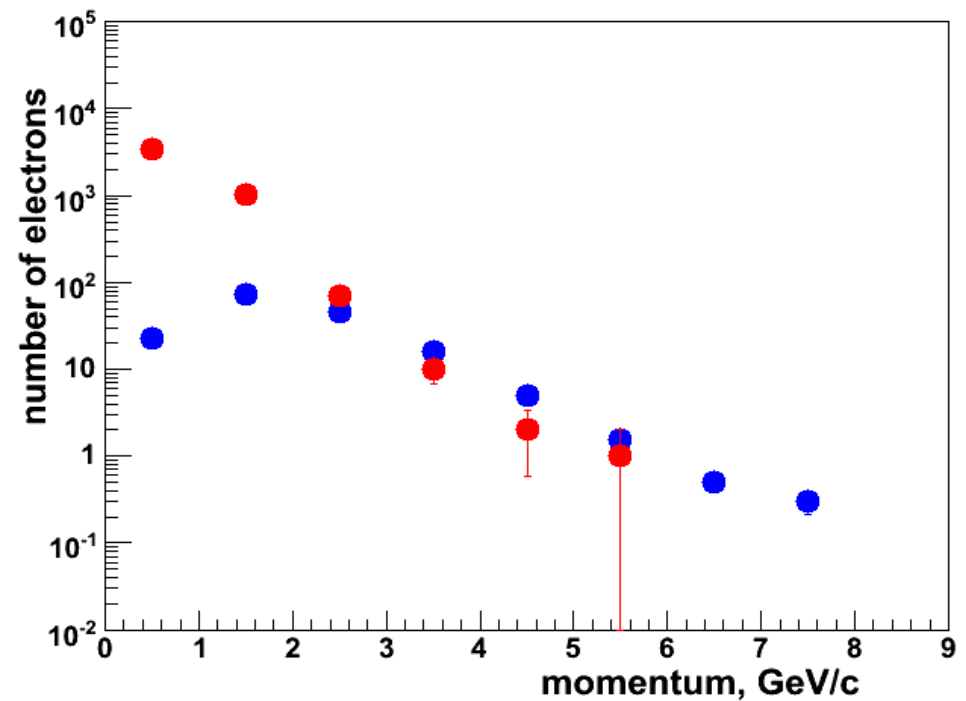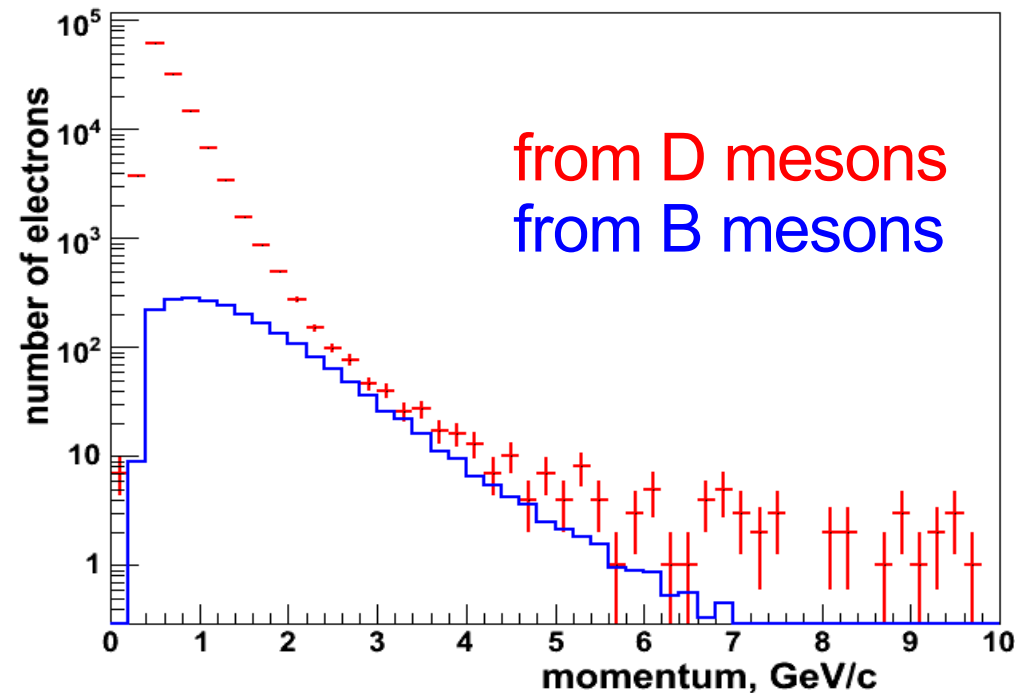
Attempt at charm/bottom separation

D and B mesons from PYTHIA

- Single D and B mesons from PYTHIA
- Full simulation and reconstruction, DCA from KalFitReco
- Properly normalized (electrons from B scaled down)
     - correspond to ~1.7B minbias pp events (~1% of run5)

all tracks

$DCA > 3\sigma(P_T),\ DCA\ \chi^2 < 150$

from D mesons
from B mesons

D and B mesons from PYTHIA (continued)

Not very encouraging
Try to look at perfect DCA
More statistics for D

0-1 GeV

red: from D mesons
blue: from B mesons
black: B/D ratio

1-2 GeV

2-3 GeV